Understanding the Emergence of Chronic Posttraumatic Stress Disorder Through Acute Stress Symptom Networks

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Letters

RESEARCH LETTER

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To accelerate recovery after traumatic events and prevent posttraumatic stress disorder (PTSD), it is critical to understand the dynamic interplay of acute stress symptoms and how they develop over time into chronic PTSD. Bryant et al[1] examined relationships among PTSD symptoms during the acute posttrauma period using network analyses. They concluded that symptoms highly central to the acute symptom network, such as intrusive trauma memories, may be especially important to the development of chronic PTSD.

We tested this prediction by examining whether acute symptoms identified as highly central by Bryant et al[1] were stronger predictors of subsequent PTSD than were low centrality symptoms in an independent sample of assault survivors. We then extended the findings by examining paths by which acute symptoms may relate to chronic PTSD.

Methods | We analyzed data from 171 assault survivors,[2] who completed a self-report assessment of acute symptoms at 2 weeks after the traumatic event and a structured clinical interview to assess PTSD diagnosis at 6 months after the traumatic event. The study was approved by the Institute of Psychiatry ethics committee and the King's College Hospital ethics committee, and participants gave written informed consent.

We used univariable logistic regression to assess individual symptoms at 2 weeks after the traumatic event as predictors of chronic PTSD diagnosis at follow-up.[3] We then calculated the correlation between the node strength centrality index from Bryant et al[1] and the odds ratios and 95% CIs from our logistic regression analyses. We used a 2-tailed *z* test ($\alpha = .05$) to assess statistical significance. All analyses were performed using R version 3.3.2 (R Project for Statistical Computing).

In addition, we constructed a network estimated with the graphical lasso and model selection based on the extended Bayesian information criterion with 6-month PTSD diagnosis integrated into the acute symptom network, and calculated the shortest path between each acute symptom and chronic PTSD (ie, the path with the smallest total edge length, in which length was the inverse of the edge weight).[4] Because shortest path analyses rely on edge weight estimates, they may be limited by the relatively low precision of some of the edge weight estimates.

Table. Acute Stress Symptom Scores in Assault Survivors

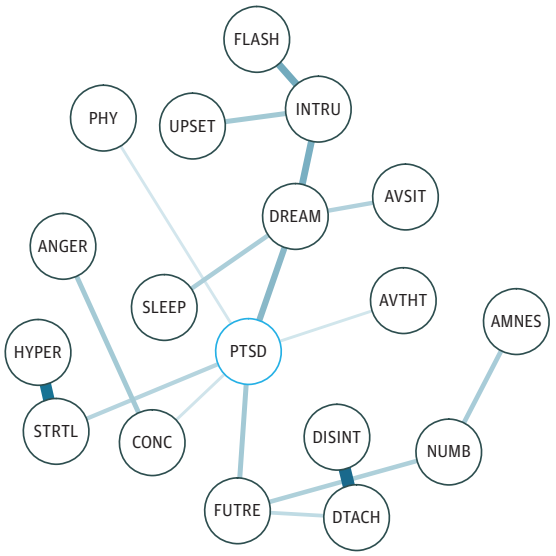
	Symptom Score >0, No. (%) (N = 171)	Symptom Score, Mean (SD)[a]	OR for PTSD Diagnosis, (95% CI)	*P* Value[b]
***DSM-IV* Symptom Cluster B: Reexperiencing**				
B1: Recurrent or distressing recollections (INTRU)	137 (80.1)	1.54 (1.03)	3.11 (1.91-5.05)	<.001
B2: Recurrent distressing dreams about the event (DREAM)	77 (45.0)	0.74 (0.97)	3.36 (2.20-5.14)	<.001
B3: Acting or feeling as if the traumatic event were recurring (FLASH)	100 (58.5)	1.04 (1.07)	2.04 (1.43-2.91)	<.001
B4: Intense psychological distress at exposure to cues (UPSET)	136 (79.5)	1.70 (1.14)	2.59 (1.66-4.03)	<.001
B5: Physiological reactivity (PHY)	92 (53.8)	0.95 (1.05)	2.56 (1.76-3.74)	<.001
***DSM-IV* Symptom Cluster C: Avoidance and Numbing**				
C1: Cognitive avoidance (AVTHT)	111 (64.9)	1.17 (1.08)	2.61 (1.76-3.86)	<.001
C2: Behavioral avoidance (AVSIT)	105 (61.4)	1.29 (1.22)	2.47 (1.71-3.56)	<.001
C3: Amnesia (AMNES)	79 (46.2)	0.91 (1.12)	1.62 (1.18-2.23)	.003
C4: Diminished interest or participation (DISINT)	83 (48.5)	0.94 (1.13)	2.59 (1.82-3.69)	<.001
C5: Feeling of detachment or estrangement from others (DTACH)	82 (48.0)	0.91 (1.12)	2.38 (1.69-3.35)	<.001
C6: Feeling emotionally numb (NUMB)	73 (42.7)	0.85 (1.13)	2.33 (1.67-3.26)	<.001
C7: Sense of a foreshortened future (FUTRE)	66 (38.6)	0.75 (1.10)	2.52 (1.80-3.55)	<.001
***DSM-IV* Symptom Cluster D: Increased Arousal**				
D1: Sleep disturbance (SLEEP)	91 (53.2)	1.09 (1.20)	1.86 (1.35-2.55)	<.001
D2: Irritability or outbursts of anger (ANGER)	95 (55.6)	1.00 (1.10)	1.66 (1.19-2.30)	.003
D3: Difficulty concentrating (CONC)	101 (59.1)	1.14 (1.15)	2.81 (1.91-4.13)	<.001
D4: Hypervigilance (HYPER)	123 (71.9)	1.54 (1.19)	2.32 (1.57-3.45)	<.001
D5: Exaggerated startle response (STRTL)	115 (67.3)	1.34 (1.17)	2.89 (1.92-4.34)	<.001

Abbreviations: OR, odds ratio; PTSD, posttraumatic stress disorder.

[a] The score range is 0 to 3; higher values indicate greater severity.

[b] Calculated using a 2-tailed *z* test.

Figure. Shortest Paths Between Acute Posttraumatic Stress and Later Chronic Posttraumatic Stress Disorder (PTSD)



Regularized partial correlation network estimated with the graphical lasso and model selection by the extended Bayesian information criterion depicting the 17 symptoms of PTSD at 2 weeks and their shortest paths to chronic PTSD at 6-month follow-up. The corresponding explanations for the symptom abbreviations appear in the Table. Blue edges indicate positive associations. Thicker and darker edges represent stronger connections. Acute symptoms appear with dark gray borders. Chronic PTSD at 6 months appears with a blue border.

Results | The odds ratios (ORs) and 95% CIs for each symptom as a predictor of subsequent PTSD diagnosis appear in the **Table.** Acute symptoms with high strength centrality in the study by Bryant et al[1] were stronger predictors of subsequent PTSD (eg, recurrent or distressing recollections [OR, 3.11; 95% CI, 1.91-5.05]) than were symptoms with low strength (eg, amnesia [OR, 1.62; 95% CI, 1.18-2.23]). Strength centrality and the corresponding symptoms' OR as a predictor of later PTSD were positively associated (r = 0.71; 95% CI, 0.35-0.89). In the shortest path analysis (**Figure**), sense of a foreshortened future (FUTRE) and recurrent distressing dreams about the event (DREAM) linked many acute symptoms to chronic PTSD.

Discussion | Researchers have argued that acute stress symptoms constitute a dynamic system of interacting symptoms. Bryant et al[1] identified the most central symptoms in an acute stress symptom network. Symptoms with high strength centrality in that study better predicted later PTSD diagnosis in our sample than did symptoms with lower strength centrality, suggesting that high centrality symptoms such as recurrent or distressing recollections may be especially important to the development of PTSD. In addition, many acute stress symptoms were linked to later chronic PTSD via 2 factors: recurrent distressing dreams about the event and a sense of a foreshortened future. Accordingly, addressing these key symptoms may also have utility in better preventing PTSD.

There is a need for better secondary prevention efforts during the initial weeks after experiencing trauma for those at risk for chronic PTSD. Our findings suggest that high centrality symptoms may be especially important in efforts to identify those at greatest risk for chronic PTSD.

Moreover, because high centrality symptoms may interact strongly with other symptoms in the network, they may be valuable targets for early intervention. Accordingly, evidence-based early intervention that targets intrusive memories and nightmares[5] or that aims to modify perceptions of a foreshortened future[6] may be especially effective in preventing the development of PTSD.

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Concept and design: Ehlers, Kleim.
Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: All authors.
Critical revision of the manuscript for important intellectual content: All authors.
Statistical analysis: Haag, Robinaugh, Kleim.
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